DOCUMENT RESUME

ED 274 334 IR 012 323

AUTHOR Simpson, Daniel D.
TITLE AUSSAT--The Australian Satellite System: Applications for Education.
PUB DATE 19 Jun 85
NOTE 18p.; Paper presented at the World Conference of the International Council for Distance Education (13th, Melbourne, Australia, August 13-20, 1986).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Communications Satellites; Cost Effectiveness; Delivery Systems; *Distance Education; Elementary Secondary Education; Foreign Countries; Instructional Materials; Interaction; *Multimedia Instruction; National Programs; Pilot Projects; Postsecondary Education; *Satellite Facilities

ABSTRACT

With the introduction of the Australian Satellite System (AUSSAT), a new era of communications will begin for all of Australia which will enhance existing distance education services by bringing more cost effective communications to a broad range of users. The improved capacity, reliability, and quality of communications will make possible the offering of Schools of the Air (SOTA) programs suitable for children or adults at home or at community locations, and will extend services beyond primary to secondary and tertiary levels. The satellite can offer students readily accessed programs that mix correspondence papers, audiotapes, and interactive audio. It can also offer television broadcasting of lessons, delivery of video resources, and television and audio materials for home tutors. Additionally, the satellite provides a communication medium both between and within institutions, video seminars, video conferences, and network link facilities for the collection and distribution of data. The advent of satellite communications has brought an opportunity for educators to conduct trials of the use of this technology and test several models over the next few years. This paper describes one such model, the School of the Air centered at Mt. Isa in Northern Australia, which will conduct a 12-month trial of the use of satellite communications. Diagrams illustrate video and audio/data signal transfers and the two-way channelling arrangement. (DJR)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED274334

INTERNATIONAL COUNCIL FOR DISTANCE EDUCATION

13TH WORLD CONFERENCE

MELBOURNE AUSTRALIA

13-20 AUGUST 1985

THEME OF PAPER

"AUSSAT - THE AUSTRALIAN SATELLITE SYSTEM: APPLICATIONS FOR EDUCATION"

by

Mr Daniel D Simpson

Marketing Division

AUSSAT PTY LTD

AUSTRALIA

19th June 1985

IR013333

BEST COPY AVAILABLE

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Daniel D. Simpson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Daniel D. Simpson - AUSSAT Marketing

Daniel Simpson joined AUSSAT Pty Ltd in June 1984 as a Marketing Representative.

After completing a Diploma in Electronic Engineering and a Bachelor of Electrical Engineering in Canada, Daniel worked for approximately five years as a Communications and Navaids and Avionics Engineer prior to emigrating to Australia.

As an Australian Citizen he has completed his Masters Degree in Business Administration (MBA) at the Australian Graduate School of Management and is currently doing Thesis Research and undertaking Postgraduate Study towards a degree of Doctor of Philosophy (PhD) on Decision Theory in Marketing at the University of New South Wales.

Since being in Australia, Daniel has held positions as an Engineering and Management Consultant with Davy McKee Pacific Pty Ltd (Melbourne, Vic,) and as a Marketing Engineer with Tyree Westinghouse (Moorebank, N.S.W.).

Daniel's aggregate work experience, complemented by a variety of relevant academic achievements, brings to AUSSAT the type of broad background that is deemed appropriate in dealing effectively with AUSSAT's existing and potential customers.

SATELLITES FOR AUSTRALIA

Communications and information may be regarded as the nervous system of contemporary societies. They are essential to all activities, particularly in matters of the country economy, and play an essential part in the development of trade, of land, sea and air transport, of health and education facilities, of public administration systems and many others.

Indeed the development of communications and information systems is recognised to be vital to a country's progress. If people are able to communicate and thereby share information, they can contribute more effectively to their society and hence continuously improve the overall standard of living.

In a country as vast as Australia with its widely spread and sparse population, communications have always been of critical importance. With the introduction of the AUSSAT Satellite System in the second half of this year, a new era of communications will begin. For the first time, all of Australia and its coastal regions will be covered by a single, comprehensive and flexible communications facility.

At long last all Australians will have the potential for the same access to communications and information, health services and education, regardless of where they live. It is difficult for city dwellers to believe that there are places in Ausralia that have no television, very poor radio reception and in many cases inadequate or non existent telephone service.

Upgrading of the National Telecommunications Network through the advent of satellite based technology will open up the possibility of placing major service organisations outside of our cities. It will also create the potential to provide Australians in remote and regional areas with services which are so often taken for granted in the cities.

DISTANCE EDUCATION - A SATELLITE PERSPECTIVE

Distance Education is not a new phenomena in Australia. For example, Queensland University offered its first external courses in 1911 and a correspondence school in NSW began in 1916. Early trials of School of the Air education facilities began during the late 1940's utilising the radio networks operated by the Royal Flying Doctor Service.

Looking briefly at what a student typically requires in the way of materials to support their course of study, many of the needed items will be found to take the form of one or more of the following:

- Text books
- Lecture notes
- Audio taped lectures
- Video and audio taped lectures
- Computer aided instruction facilities

The availability of quality telecommunications at relatively low cost can, in some instances, substitute and, in most instances, complement educational tools which are normally provided in the above-mentioned standard forms.

The problem with terrestrially based telecommunications is that they are largely point to point with cost being a direct function of the number of points to be linked and the distance between them. Furthermore, where only limited facilities are available (ie when the only available medium is the public telephony network), it is inappropriate to tie up these services for long periods of time.

Alternatively, where over the air point to multipoint systems are in use they currently depend on HF radio which is well known as a somewhat variable quality medium for telecommunications.

AUSSAT, on the other hand, will provide the ability to improve capacity, reliability and quality in communications and extend opportunities beyond those currently available for distance education.

Through the use of AUSSAT, for example, Schools of the Air will be able to offer programs suitable for all the children and adults in their homes or to a central location within the local community. Additionally, services can be extended beyond primary levels to include secondary and tertiary education to those students who, through circumstance, are unable to leave home to attend normal schools or tertiary institutions.

Farmers and rural workers can be kept up to date with new developments in pastoral, agricultural and related fields. Workers in mineral, oil and gas exploration could be kept up to date by continuous and instantaneous contact with their city based head offices.

Teachers working in small remote schools could benefit from in-service courses received via satellite. New curriculum materials could be demonstrated and information between teachers in different locations exchanged.

AUSSAT satellites have the capacity to handle the whole range of telecommunications signals, from video and high speed data to a single voice low speed data channel. These services can either be one way or two way. With the appropriate earth station equipment, transmitting and receiving sites can be located anywhere within Australia.

Against this imminently new Australian communications ability, AUSSAT will, in conjunction with the Queensland Department of Education, conduct a 12 month's trial using satellite communications. The centre will be located at the Mt Isa School of the Air facility. More details of this trial will be given later in this paper.

SATELLITES - THE STATED ADVANTAGE

The satellite provides the facility for two or more earth stations to communicate with the same clarity whether they are located in the same city or at opposite corners of the Australian Continent. This is an inherent feature of the high quality satellite radio link which will be capable of being established through AUSSAT. There are no restrictions on the geographical location of an earth station within Australia. The antenna size of each station can be relatively small giving the user the opportunity to place the earth station in the most convenient position.

The attractions of using satellites can be generally summarized as follows:

1. The satellite offers a wide channel band width and is therefore as suited to transmitting television as it is to transmitting narrow band data or voice. This feature offers some interesting possibilities to the education environment in particular in the realms of live or pre-recorded education video transfer to remote students. The video element has been generally accepted as providing a useful dimension to the distance education process.

2. The cost of transmitting information from one point to another is independent of distance. Thus the cost of sending a message, a burst of data or television picture between Melbourne and Brisbane is respectively the same as the cost to send the same information between Melbourne and Geelong, or between Brisbane and Mt Isa for example. This also allows distance education courses to realistically extend over large coverage areas without introducing unacceptable delays in correspondence turn around times. It could, for instance, give rise to the "OPEN UNIVERSITY" concept in the Australian context and in a very cost effective way.

3. Telecommunications satellites have a multi destination capability. That is, they can make the same information available to an unlimited number of destinations within Australia, for the cost of one transmission through the satellite. For example an educational television program sent up to the satellite from Melbourne can be received simultaneously at any number of educational institutions or by individual students anywhere throughout Australia. The implication here for the delivery of primary, secondary and tertiary education programs are great indeed.

4. The satellite system can be readily accessed simultaneously by a number of individual students or groups of students. That is, signals to and from the satellite can be transmitted and received from any location in Australia regardless of whether that location is in the centre of Melbourne or in the centre of Australia. This feature of course is a basic requirement for inter-active types of distance education such as those utilizing radio signals and covering vast geographic areas. Moreover, inter-activity in real time stimulates and maintains a keen learning environment beyond that which

exists with paper based correspondence education or one way radio education services. For maximum effect, the satellite offers a means to do this reliably and in whatever scale deemed appropriate by the educators of Australia.

CURRENT SCHOOL OF THE AIR (SOTA) - WHY AND HOW?

The Schools of the Air provide complementary and supplementary services to those provided by primary correspondence schools (PCS). The role of the SOTA's includes support for home tutors in the interpretation of PCS papers, development and enrichment of rural communications, motivation of children from PCS papers, identification of learning and speech difficulties, and provision of an avenue of socialisation through the daily peer contact as well as specifically arranged activity days.

Class contact time for students of SOTA's is usually 30 minutes per day although individual student contact time is obviously considerably less.

HF radio is currently used to meet the communication needs of Schools of the Air because it is the only medium presently available which is capable of reaching a class of students separated by considerable distances. The students HF radio transceivers are reasonably priced and the cost of operating and maintaining these transceivers is not significant. Other technologies such as new VHF radio relays require the installation of repeaters at intervals of 30-40 kilometres and will be impractical for the large areas normally covered by The Schools of the Air.

Although HF radio links are used by all SOTA's there are several limiting characteristics:

1. The links will support only voice type signals. This is a feature which is inherent in the HF mode of communications used.

2. The teacher-to-student links are fairly clear but those from student-to-teacher tend to be much poorer and require the teacher's close concentration to hear what the students are saying. The links are subject to fade outs during some periods of the day and some seasons of the year, and may be interrupted completely for 24 to 48 hours at a time. Sometimes even close concentration by the teacher is not adequate to allow some students to participate. The end result could be to abandon the effort until a later time causing disruption not only to the teacher's itinerary but perhaps more importantly to the students involved.

3. The scarcity of frequency spectrum makes it difficult to obtain additional radio channel allocations to provide for additional classes. This limitation is becoming increasingly important as our general need for communications of all sorts within Australia grows exponentially. In some areas this already causes long delays and limited access to existing communications facilities.

Use of the telephone for execution of education services has also been impractical in some circumstances for the following reasons:

1. Unavailability of telephone lines to all students. This is of primary concern to much of Australia's "outback" targets for improved education services.

2. Due to the party line nature of some of the services.

3. Due to the higher priority of other uses of the telephone.

4. Due to the telephone charging system which is time and distance dependent resulting in very high cost of delivery. With the numbers involved, cost viability is a "necessary evil". It is difficult to achieve when the cost structure is based on the normal telephony service complete with its cost dependence on time and distance.

It is felt that the current technology available to The Schools of the Air limits its operation, its range of services and the quality of education provided. Satellite technology will enable an expansion in the variety of services available, the quality of the programs offered and an increased speed of reaction to all the various student needs. Immediate transfer of assignments to and from the students will help avoid the uncertainties of delayed feedback. This will serve to not only stimulate but to maintain the interest and participation of the students through enhanced real time interaction with the teacher.

SCHOOL BY SATELLITE - AUSSAT'S CO-OPERATION

With the implementation of a service based on satellite technology, the vast majority of the School of the Air students could be provided with a program which mixes correspondence papers, audio tapes and other resources such as interactive audio in a manner similar to the existing HF SOTA's but with improved quality and reliability. The end result, by the satellite network's very nature, must be a more efficient use of available teaching resources. In addition the satellite can also offer television broadcasting of lessons to students, delivery of video resources to students, and television and audio materials for home tutors. Essentially, with the expanded range of communications available by using the satellite system a broadening of the curriculum offerings can be expected and most certainly is anticipated.

In a typical scenario for the simplest satellite based system, each class would be operating concurrently and be allocated a single channel through the satellite. All of the earth stations in a class, those used by the teacher and the students, would transmit and receive on the same frequency. The teacher by transmitting sub-audio signals on the channel, for example, could control student transmissions as deemed necessary.

It is worth noting however, that, there is one problem with this "simplest of systems". Students' signals may from time to time interfere with teacher's channel and this could cause some

disruption to the class proceedings. With the exception of this slight anomoly, which is a function of the mode of operation through the satellite of this particular scenario, this system is essentially the present H.F. method translated into a satellite application. This arrangement does not make optimum use of the AUSSAT satellite medium for distance education services of this type. In order to establish the most effective means of using this new technology in the Australian context, a trial is being planned. The design of the trial is such that the ongoing results and the final outcome will give insight into how the satellite system may best service the needs of many aspects of Australian education.

The Mt Isa's School of the Air Trial commencing in January 1986 and lasting approximately one year involves a transfer of eight (8) level 6 Homestead students, selected by the Queensland Department of Education, to a satellite based School of the Air communications link. It is currently envisaged that the satellite will provide two way voice, two way data and one way video as the basis for testing a variety of pedagogic models generated by the education specialists in the Queensland Department of Education. The Trial is being staged as a co-operative effort between the Queensland Department of Education and AUSSAT Pty Ltd.

The main objective is to trial a satellite based replacement for, and/or enhancement to the existing School of the Air HF radio system. The network and peripheral hardware arrangements have been chosen to effectively test the range of attributes of satellite transmission.

The network will operate in the standard configuration with all transmissions between students passing through the "hub" located in Mt Isa. Placing a high performance station at the hub allows lower level return signals and in turn results in lower satellite lease cost for channels with a low usage factor. To achieve the required flexibility, separate channels will be allocated for the teacher and each student. At the hub earth station all the students' channels will be separately received and then combined at base band level for re-transmission. All information will be broadcasted over one of the two teacher's channels. In addition to providing two way voice and data, the network will include one way video received by the student minor earth stations with the uplink via the AUSSAT Major City Earth Station at Brisbane.

One of the features which is designed into The School of the Air Trial system, is the special user interface equipment which will be located at Mt Isa. This equipment virtually transforms the network from a set of communicating small earth stations, to a flexible instrument of education. The functioning network will give the capability of testing and utilising a variety of teaching techniques and education models via satellite. The need for this type of additional hardware was identified through discussions between AUSSAT and the education specialists in the Queensland Department of Education. Briefly, the system design is such that, with this additional user interface hardware, many useful features such as the segregation of individual students or groups of students within in The School of the Air class will be made possible. This feature among other perceived benefits allows for special tuition or problem solving sessions to occur

under the teacher's control. This is accomplished through a "matrix switching" arrangement which allows the selective mixing of incoming student transmissions. To close the loop, the switching is also combined with the availability of two broadcast channels from the teacher's station at Mt Isa. The teacher is thus provided with a variety of control features which will be commanded from The School of the Air facility at Mt Isa. Other control may include the ability to signal an intention to send data for down loading into a small computer at the Homestead. Alternatively the teacher will be able to receive data at Mt Isa which was transmitted from the student terminals. There is little doubt that once in the hands of the SOTA teachers, many, many more educational uses of the satellite based SOTA network will be revealed and subsequently experimented with.

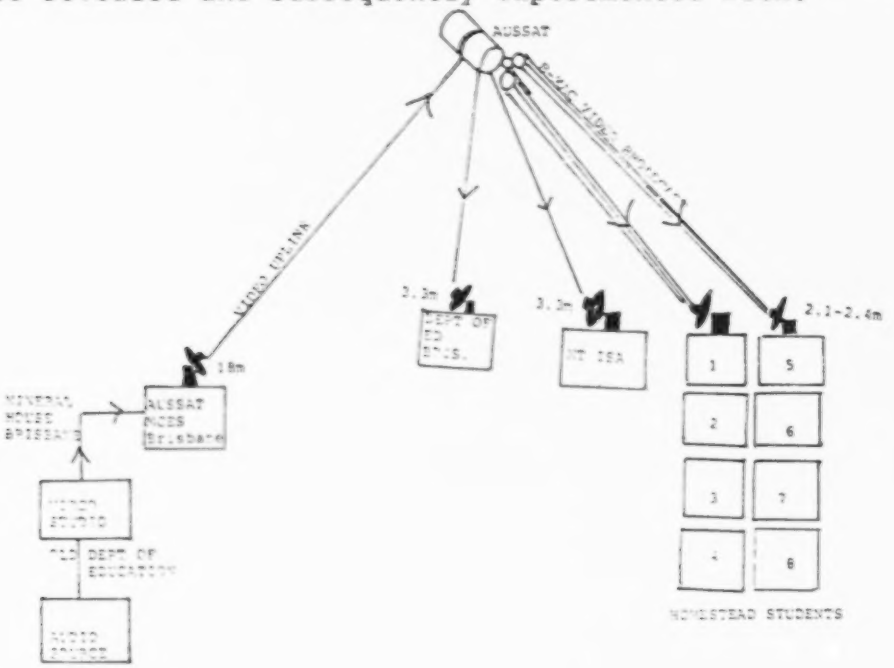

Figure 1 - Video.

It is pointed out again that the trial is being planned to make optimum use of the capabilities offered by the AUSSAT satellite and the AUSSAT Major City Earth Station located at Rochedale in Brisbane. The trial will provide a practical demonstration of additional educational services which will be achieved through the extended use of the satellite. Through AUSSAT's co-operation, the opportunity to provide the latest in education technology to even the most remote parts of the country is soon to become a reality.

The video signal in the form of live to air programming or perhaps some pre-recorded material will originate from the Queensland Department of Education facilities. The signal will be transferred via microwave link to the AUSSAT Major City Earth Station at Rochedale where it will be reformatted from the PAL TV signal to Multiplexed Analogue Component (Type B) or the B-MAC format. Uplinking will then occur through the Major City Earth Station's video exciter hardware and ultimately the video will be transmitted through AUSSAT's 18 metre antenna assembly at Rochedale.

The video will be received directly by the student earth stations from the designated 12 watt satellite transponder on one of AUSSAT's three planned satellites. The particular transponder will be working into a focussed coverage area known as the North-East footprint. This NE beam is designed essentially to cover all of the State of Queensland.

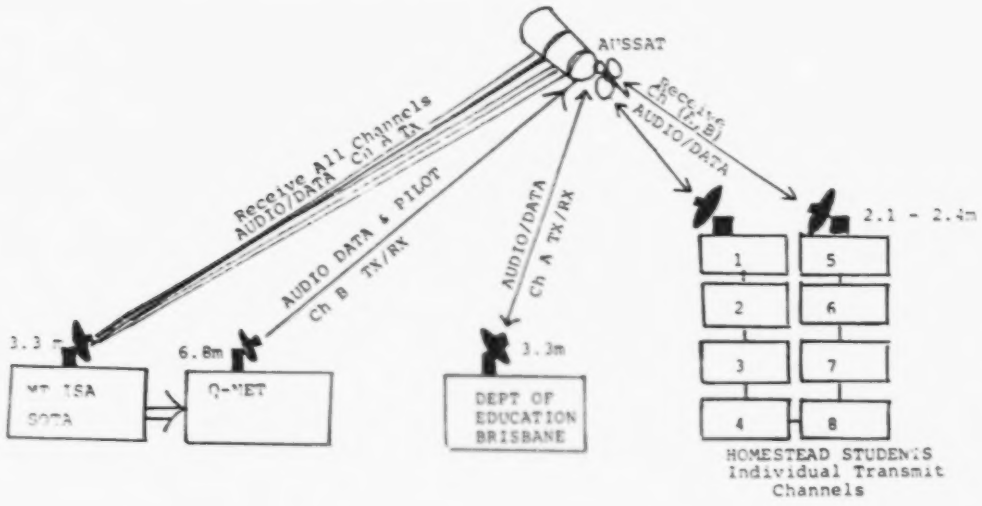

Figure 2 - Audio/Data

This figure depicts the two way channelling arrangement for the SOTA trial. Briefly, the student minor earth stations have been allocated separate channel frequencies through the AUSSAT satellite. This allows simultaneous student transmissions to occur through the satellite which, as mentioned earlier, will be aggregated or mixed and re-broadcast from the teacher's hub station located at Mt Isa. There are a multitude of both educational and 'student socializing' advantages to this arrangement which have been discussed in some detail previously in this paper. The design of the whole system has evolved such that it will allow a variety of teaching & educational models to be tested through the network. In short, the pedagogic software being developed by the Queensland educationalists is expected to take full advantage of the satellite links' clarity, reliability and flexibility.

It is worth noting that some interfacing has occurred with the Queensland State Government network (Q-NET) which is shown here as providing one of the two Mt Isa Audio/Data uplinks. This link to Q-NET has required that AUSSAT take the technical features of both systems into consideration during the final network design stages. It offers a good example of AUSSAT's ability to develop several discrete communication systems, with diverse features performing different functions, into an integrated, efficient and functionally reliable network.

OTHER APPLICATIONS IN THE EDUCATION ENVIRONMENT

Whilst this paper has dealt at some length with the School of the Air application, this is only one example of the wide range of applications which the satellite opens up for distance education. The characteristics of satellite networks which are relevant to distance education clearly offer benefits in many other areas of education. Some of these uses include the provision of a communication medium between major institutions and even within single institutions where campus's are separated by significant distances. These uses are particularly attractive in cases where earth station facilities can be shared with other users or where AUSSAT Major City Earth Station facilities can be utilised.

Apart from extending the reach of conventional types of tuition enhancing student/professional development and allowing reliable information networking among distant students and institutions, the satellite opens the possibility for video seminars providing the opportunity, for instance, for visiting overseas specialists to address institutions throughout Australia. This feature will minimise the amount of travelling that the visiting overseas specialists would have to do and substantially broaden the audience that he is able to reach during his visit to this country. The satellite also provides the opportunity to conduct video conferences between various centres where specialists in particular disciplines can consult with one another in an almost face to face situation. Video conferences could also be used for administration of education.

To support the administrative purpose in education, the satellite offers the same sort of potential as it would do for any other network user. It provides, for instance, an ability to create a network link facility with a particular institution or group of institutions, allowing the collection of data at a central point and the distribution of data from that central point (ie star network). Another aspect which makes this particularly attractive is the growing need for computer interfaced high speed information transfer. There is an escalating demand for data held in data bases both in Australia and throughout the world. Whether this data is located at universities, colleges, libraries or wherever, the need for access to high speed information transfer is certainly upon us. Satellite based networks lend themselves to this requirement quite readily and the location of the users of such a network, as mentioned earlier, can be anywhere in Australia.

INDICATIONAL SATELLITE SYSTEM COST

By way of example the cost estimate based on a typical "School of the Air" application as described earlier, is discussed in this section. The system could be adapted to other teaching situations either with little change, or by the addition of terminal devices such as computer terminals, facsimile machines or electronic blackboards. The earth station can also be equipped to receive broadcast programs, and for the reception of video transmissions.

(A) SPACE SEGMENT

With a dish size of around 2.5 metres in diameter, approximately 200 one way voice channels could be carried by one national beam low power transponder. Assuming two voice channels are required for each class, then in the extreme case, a hundred independent one hour classes could be conducted in all parts of Australia through the satellite simultaneously. When more channels per class are required the number of simultaneous classes would reduce accordingly. The total satellite usage cost would be around $800 for the hour.

On the basis of $800 per hour, the total yearly satellite cost can be calculated for any given teaching situation. For example, one hour per day, five days a week, 25 weeks a year would amount to $100,000 per annum and, as mentioned above, this could potentially serve a hundred classes of students right across Australia. Additional hours of satellite capacity would be available.

The above discussion assumes that a national beam transponder would be used to satisfy educational needs right across Australia and therefore employs the simultaneous sharing of the time slot and the lease costs by various educational organisations. It should be noted that the use of the low power spot beam transponder to serve regional needs is currently being developed for the Mt Isa School of the Air satellite based trial.

(B) EARTH STATION HARDWARE

Information to hand on the cost of small two way earth stations purchased in reasonable quantities indicates that an earth station located on a remote property would probably cost in the order of $15,000 to $20,000 to purchase and $5,000 to install.

The teachers or "hub" earth stations would be typically greater in size from that of the student earth stations. This would allow the teacher to handle one or more classes simultaneously and the cost would only marginally be more than the student earth station provided the diameter of the teacher station dish does not exceed 4.5 metres approximately. Each station and accompanying hardware would need to be dimensioned to meet the particular requirements at hand. Some variables such as the number of classes to be held simultaneously or the need to uplink sound or television broadcasts must be considered. As mentioned earlier these earth stations could be located as required at either city or country centres and in fact each session could be conducted by a variety of different hosts in a variety of different locations during one School of the Air class period. It is also conceivable that one earth station could serve a number of students dispersed around a single earth station location. This might be accomplished through a VHF/UHF concentrator system or some other similar type of extension network and could improve cost viability quite considerably when required.

In general it is believed as the technology of the small earth stations matures their prices in real terms will fall. The other significant factor in determining cost is production quantities. Obviously the larger the number ordered the lower the cost.

CONCLUSION

The National Satellite System allows the concept of teaching isolated students to be thoroughly upgraded. It will also provide a means which will greatly enhance distance education services and allow such services to be extended to a larger potential user group.

The examples given in this paper have gone some way in showing that the satellite is an ideal means of providing high quality voice communications, transferring data to and from micro-computers and providing for distribution of audio and video material for teacher to class, teacher to teacher, specialist to group of teachers, guest overseas specialist to Australian teachers and so on.

AUSSAT Pty Ltd has demonstrated a keen interest in the enhancement of education facilities through its involvement and support of the Mt Isa School of the Air trial project. AUSSAT has also taken part in preliminary discussions around a second trial to be staged in the tertiary education environment. Through these efforts, the educators of this country are being given the opportunity to test out Australian satellite technology as an efficient and effective complementary addition to the already comprehensive list of educating tools.

The Australian satellite program will also bring significant benefits in the form of extending and strengthening Australia's existing telecommunications capability by bringing more cost effective communications to a broad range of users. It will be the catalyst for the transfer of new technologies and industries in this country and a stimulus to the improvement of the Australian level of awareness, standard of living and the rate of economic development throughout the Nation.

The advent of the AUSSAT satellite system has been and will continue to be the catalyst for industrial and education restructuring which will be necessary to take Australia's economy away from the traditional profile of primary industry and heavy secondary industry and into the high technology areas. This evolutionary change is clearly the pre-requisite for economic growth for the rest of the 20th century within Australia.

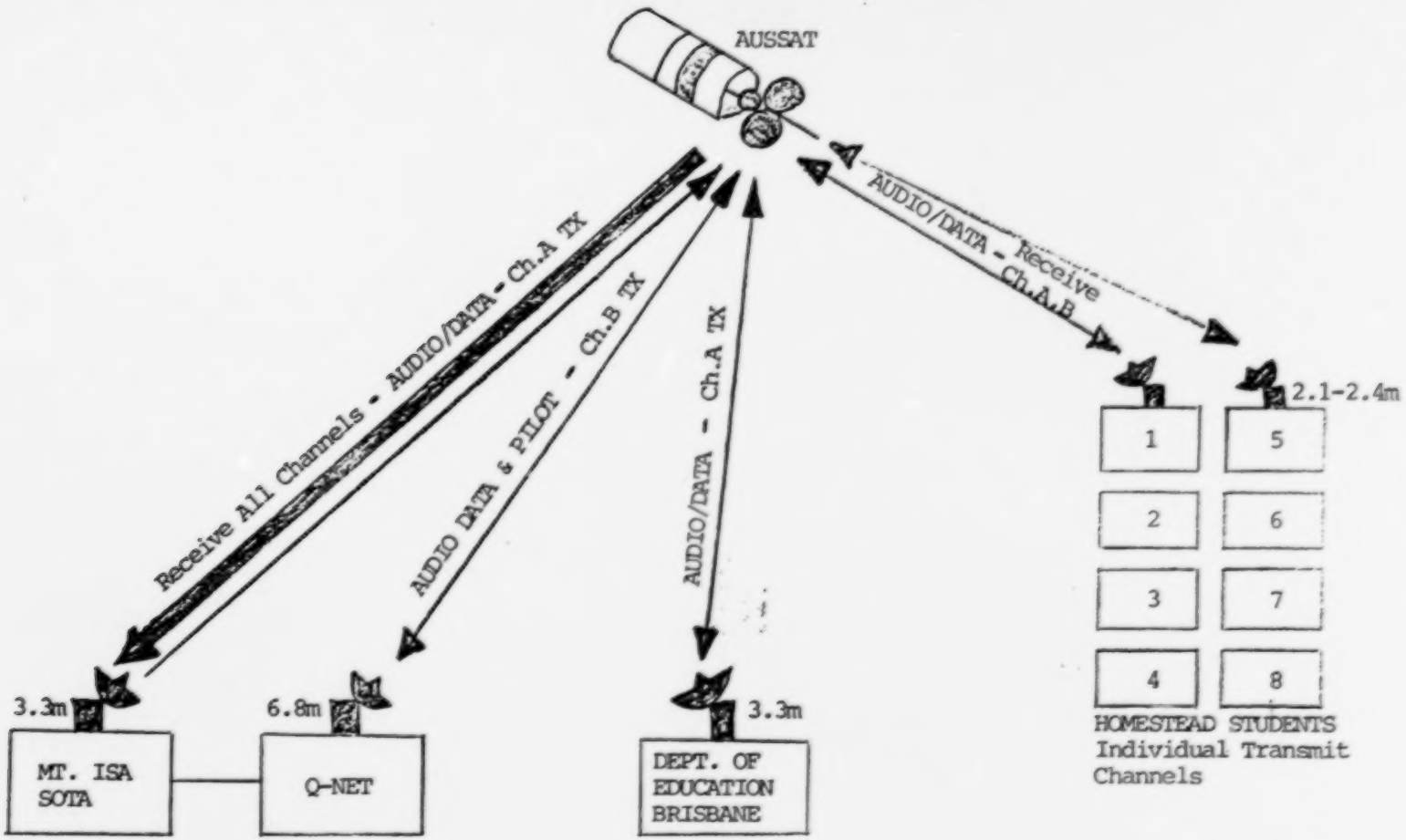
AUSSAT
Receive All Channels - AUDIO/DATA - Ch.A TX
AUDIO DATA & PILOT - Ch.B TX
AUDIO/DATA - Ch.A TX
AUDIO/DATA - Receive Ch.A,B
2.1-2.4m
1
2
3
4
5
6
7
8
HOMESTEAD STUDENTS
Individual Transmit Channels
3.3m
MT. ISA SOTA
6.8m
Q-NET
3.3m
DEPT. OF EDUCATION BRISBANE

FIGURE 2

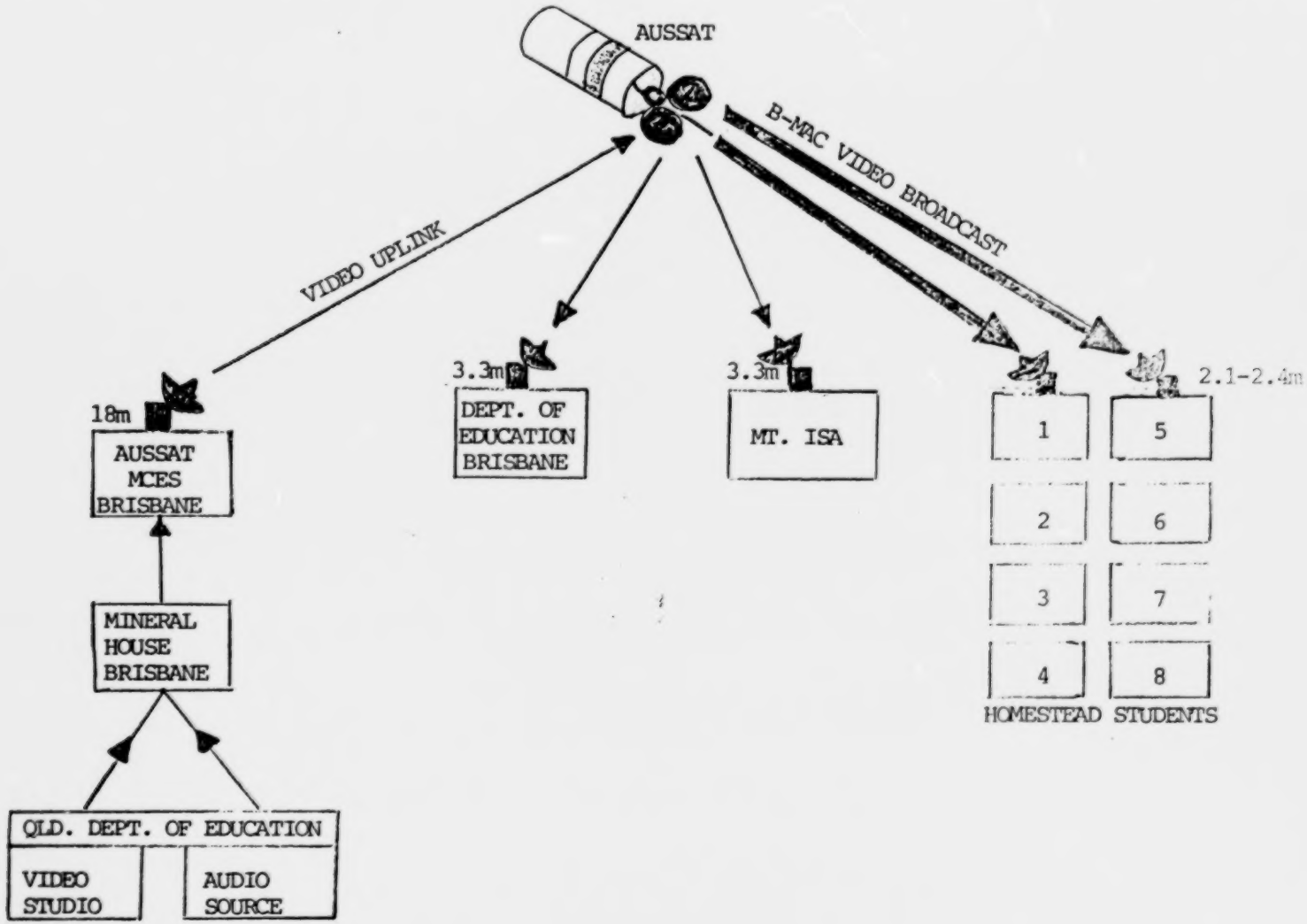
AUSSAT
B-MAC VIDEO BROADCAST
VIDEO UPLINK
18m
AUSSAT
MCES
BRISBANE
3.3m
DEPT. OF
EDUCATION
BRISBANE
3.3m
MT. ISA
2.1-2.4m
1
2
3
4
5
6
7
8
HOMESTEAD STUDENTS
MINERAL
HOUSE
BRISBANE
QLD. DEPT. OF EDUCATION
VIDEO
STUDIO
AUDIO
SOURCE

FIGURE 1.